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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/802,375	03/09/2001	Nazir Ahmad	CPAC 1002-IUS	8400
22470	7590	12/01/2005	EXAMINER	
HAYNES BEFFEL & WOLFELD LLP			VU, HUNG K	
P O BOX 366			ART UNIT	
HALF MOON BAY, CA 94019			PAPER NUMBER	
			2811	

DATE MAILED: 12/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

HA

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	09/802,375	AHMAD ET AL.	
	Examiner	Art Unit	
	Hung Vu	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 July 2005.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 1-13 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### **DETAILED ACTION**

1. Applicants' communication filed 07/15/05 has been carefully considered by the examiner. The arguments advanced therein are persuasive with respect to the rejections of record, and some of those rejections are accordingly withdrawn. In view of a further search, however, a new rejection is set forth further below. This action is not made final.

#### ***Specification***

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

#### ***Claim Objections***

3. Claims 14, 15 and 18 are objected to because of the following informalities:

In claim 14, last line, "the material" (2 occurrences) should be changed to "a material", for clarity.

In claim 15, line 2, "the bump surface" should be changed to "a bump surface", for clarity.

In claim 15, line 2, "the surface" should be changed to "a surface", for clarity.

In claim 18, line 4, "the material" (2 occurrences) should be changed to "a material", for clarity.

In claim 18, line 7, "the bump" should be changed to "a bump", for clarity.

In claim 18, line 8, "the surface" should be changed to "a surface", for clarity.

Appropriate correction is required.

*Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 14 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Scharr et al. (PN 5,346,857, of record).

Scharr et al. discloses, as shown in Figure 2, a chip package structure comprising

a chip (26) having bumps (28) formed thereon and a substrate (21) having interconnect points on a metallization (23) thereon, the bumps (28) forming contacts with the interconnect points, wherein each the contact comprises an interconnection layer situated at an interface between the bump (28) and the interconnect point (metallization layer 23) in contact therewith, the layer comprising an alloy (a region indicated by line 29) of the material of the bump (28) and the material of the metallization (23) (column 3, line 54 – column 4, line 16).

Regarding claim 16, Scharr et al. teach the bump (28) material comprises gold and the interconnect points (metallization 23) comprise Sn, and the alloy (a region indicated by line (291) at the interface comprises an Au/Sn alloy (column 3, line 54 – column 4, line 16).

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5. Claim 14 is rejected under 35 U.S.C. 102(e) as being anticipated by Milewski et al. (PN 6,330,967).

Milewski et al. discloses, as shown in Figures 4-6, a chip package structure comprising

a chip (10) having bumps (35) formed thereon and a substrate (21) having interconnect points (48) on a metallization thereon, the bumps forming contacts (39) with the interconnect points, wherein each contact comprises an interconnection layer situated at an interface between the bump and the interconnect point in contact therewith, the layer comprising an alloy of the material of the bump and the material of the interconnect point [Col. 4, line 49 – Col. 6, line 15].

### *Claim Rejections - 35 USC § 103*

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 15, 18 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scharr et al. (PN 5,346,857, of record) in view of Yoshino (PN 5,959,362).

Regarding claims 15 and 18, Scharr et al. discloses the claimed invention including the chip package structure, as explained in the rejection above. Scharr et al. does not disclose a cured adhesive polymer is situated in a middle region between a bump surface of the chip and a surface of the substrate. However, Yoshino disclose a cured adhesive thermoset epoxy resin (8a,8b) (which is a polymer) is situated in a middle region between a bump surface of a chip (5) and a surface of a substrate (1). Note Figures 3A-5B of Yoshino. Therefore, it would have been

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obvious to one of ordinary skill in the art at the time the invention was made to form the structure of Scharr et al. having the cured adhesive polymer situating in a middle region between a bump surface of the chip and a surface of the substrate, such as taught by Yoshino in order to improve the adhesion between the chip and the substrate.

Regarding claim 19, Scharr et al. teach the bump (28) material comprises gold and the interconnect points (metallization 23) comprise Sn, and the alloy (a region indicated by line (291) at the interface comprises an Au/Sn alloy (column 3, line 54 – column 4, line 16).

7. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Scharr et al. (PN 5,346,857, of record) in view of Citowsky (PN 4,875,617).

Scharr et al. discloses the claimed invention including the chip package structure, as explained in the rejection above. Scharr et al. further discloses heating the structure to a temperature ranging between approximately 280°C to 315°C to form the alloy of Au/Sn. Scharr et al. does not disclose the alloy comprises a 20:80 Sn:Au alloy. However, Citowsky discloses when an Au/Sn alloy is heat to a temperature ranging between approximately 280°C, the alloy will comprise 20:80 Sn:Au alloy. Note Figure 1, at point E of Citowsky. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the alloy of Scharr et al. comprising 20:80 Sn:Au alloy, such as taught by Citowsky in order to increase the reliability of the lead bonded integrated circuit chip.

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8. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Scharr et al. (PN 5,346,857, of record) in view of Yoshino (PN 5,959,362) and further in view of Citowsky (PN 4,875,617).

Scharr et al. and Yoshino disclose the claimed invention including the chip package structure, as explained in the rejection above. Scharr et al. and Yoshino further disclose heating the structure to a temperature ranging between approximately 280°C to 315°C to form the alloy of Au/Sn.

Scharr et al. and Yoshino do not disclose the alloy comprises a 20:80 Sn:Au alloy. However, Citowsky discloses when an Au/Sn alloy is heat to a temperature ranging between approximately 280°C, the alloy will comprise 20:80 Sn:Au alloy. Note Figure 1, at point E of Citowsky.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the alloy of Scharr et al. and Yoshino comprising 20:80 Sn:Au alloy, such as taught by Citowsky in order to increase the reliability of the lead bonded integrated circuit chip.

9. Claims 15, 18 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milewski et al. (PN 6,330,967) in view of Yoshino (PN 5,959,362).

Regarding claim 15, Milewski et al. discloses the claimed invention including the chip package structure, as explained in the rejection above. Milewski et al. does not disclose a cured adhesive polymer is situated in a middle region between a bump surface of the chip and a surface of the substrate. However, Yoshino disclose a cured adhesive thermoset epoxy resin (8a,8b) (which is a polymer) is situated in a middle region between a bump surface of a chip (5) and a surface of a substrate (1). Note Figures 3A-5B of Yoshino. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the cured adhesive polymer

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situating in a middle region between a bump surface of the chip and a surface of the substrate, such as taught by Yoshino in order to improve the adhesion between the chip and the substrate.

Regarding claim 18, Milewski et al. discloses, as shown in Figures 4-6, a chip package structure comprising

a chip (10) having bumps (35) formed thereon and a substrate (21) having interconnect points (48) on a metallization thereon, the bumps forming contacts with the interconnect points, wherein each contact comprises an alloy (39) of the material of the bump and the material of the interconnect point, the alloy being limited to a layer situated at an interface between the bump and the interconnect point [Col. 4, line 49 – Col. 6, line 15].

Milewski et al. does not disclose a first cured adhesive polymer forming a spot situated in a middle region between a bump surface of the chip and a surface of the substrate, there being no first cured adhesive polymer at the contacts. However, Yoshino discloses a first cured adhesive thermoset epoxy resin (8a) (which is a polymer) forming a spot situated in a middle region between a bump surface of a chip (5) and a surface of a substrate (1), there being no first cured adhesive polymer at the contacts. Note Figures 3A-5B of Yoshino. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the cured adhesive polymer situating in a middle region between a bump surface of the chip and a surface of the substrate, such as taught by Yoshino in order to improve the adhesion between the chip and the substrate.



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Regarding claim 21, Milewski et al. and Yoshino disclose the structure further comprising a second cured adhesive polymer forming an underfill (8b).

10. Claims 16 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milewski et al. (PN 6,330,967) in view of Scharr et al. (PN 5,346,857, of record).

Regarding claim 15 and 19, Milewski et al. discloses the claimed invention including the chip package structure, as explained in the rejection above. Milewski et al. does not disclose the bump material comprises gold and the interconnect points comprise Sn, and the alloy at the interface comprises a Au/Sn alloy. However, Scharr et al. discloses a chip package structure comprising the bump material comprises gold and the interconnect points comprise Sn, and the alloy at the interface comprises a Au/Sn alloy. Note Figure 2 of Scharr et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the bumps and the interconnect points of Milewski et al. having the material as claimed, such as taught by Scharr et al. in order to reduce the contact resistance between the chip and the substrate.

Regarding claims 17 and 20, Milewski et al. and Scharr et al. disclose the alloy at the interface comprises a 20:80 Sn:Au alloy.

11. Claims 17 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milewski et al. (PN 6,330,967) in view of Scharr et al. (PN 5,346,857, of record) and further and further in view of Citowsky (PN 4,875,617).

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Milewski et al. and Scharr et al. disclose the claimed invention including the chip package structure, as explained in the rejection above. Milewski et al. and Scharr et al. further disclose heating the structure to a temperature ranging between approximately 280°C to 315°C to form the alloy of Au/Sn. Milewski et al. and Scharr et al. do not disclose the alloy comprises a 20:80 Sn:Au alloy. However, Citowsky discloses when an Au/Sn alloy is heat to a temperature ranging between approximately 280°C, the alloy will comprise 20:80 Sn:Au alloy. Note Figure 1, at point E of Citowsky. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the alloy of Milewski et al. and Scharr et al. comprising 20:80 Sn:Au alloy, such as taught by Citowsky in order to increase the reliability of the lead bonded integrated circuit chip.

### ***Response to Arguments***

12. Applicant's arguments filed 07/15/05 have been fully considered but they are not persuasive.

It is argued, at pages 7-9 of the Remarks, that Scharr et al. discloses heating the structure to a temperature in the range 280°C to 315°C for in excess of 3 to 10 seconds, the alloyed region of Scharr et al. will not be a thin layer, but the alloyed region could make up the entire bump. This argument is not convincing for the following reasons:

First, it is noted that the features upon which applicant relies (i.e., a thin layer) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988

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F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Further, Applicant does not describe how thin is thin?

Second, Scharr et al. discloses heating the structure to a temperature in the range approximately 280°C to 315°C to form the alloy of Au/Sn at the region 29. According to Citowsky (PN 4,875,617) or Appendix A (of record), at the temperature of 280°C, which is at point E, the alloy of Au:Sn 80:20 is formed. When the alloy of Au:Sn 80:20 is formed, there is no need to continue heating up the structure. Therefore, Sn will not diffuse into the Au bumps, but instead forming a layer at the interface between the bump and the interconnect point.

13. Applicant's arguments with respect to claims 15-21 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung Vu whose telephone number is (571) 272-1666. The examiner can normally be reached on Tuesday to Friday 6:00-4:30.

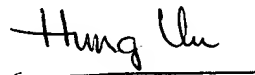
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272 - 1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Vu

November 17, 2005

A handwritten signature in cursive script, appearing to read "Hung Vu", is written over a horizontal line.

Hung Vu

Primary Examiner